

measurements, based on the photographs taken in 1913, only twenty-one gave an altitude under 90 km., and only sixteen an altitude above 220 km., the highest being 323 km. Nearly 70

the fact that in 1910 he observed heights under 50 km. on several occasions. Moreover, unless this proves to be the case, or auroras attain much lower levels in Greenland than in Norway, we must suppose Prof. Paulsen's estimates to have been seriously at fault. The frequent association of aurora with magnetic disturbance gives an additional interest to Prof. Störmer's work. It is of obvious importance to have exact information as to the changes in progress in aurora during the large movements frequently shown on magnetograms during magnetic storms.

C. CHREE.

THE DYE PROBLEM AMONG THE ENTENTE POWERS.

THE synthetic dye problem as it presents itself to the French chemist was admirably stated by Prof. Auger in an address delivered on February 11 to the Société des Amis de l'Université de Paris. For more than forty centuries the

art of the dyer was restricted by the narrow choice of available colouring matters. The ancients were acquainted with only ten dyeing principles, namely, Tyrian purple, madder, archil, weld, Persian berries, anatto, woad, indigo, catechu, and

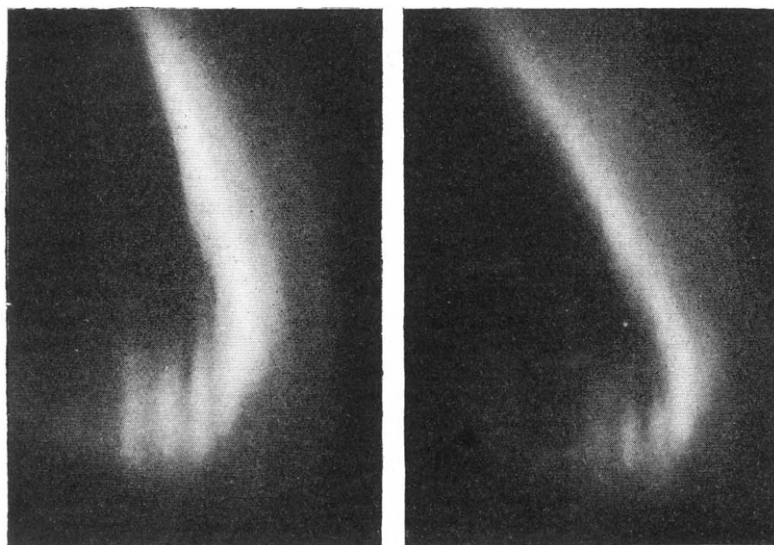


FIG. 1.—Aurora borealis, photographed simultaneously from Bossekop (right) and Store Korsnes (left) on March 17, 1913, 11h. 36m. G.M.T. Altitude of the lowest parts 93–99 km. The star is Deneb.

per cent. of the heights ranged between 96 and 120 km. Prof. Störmer claims that, as regards frequency of occurrence, the results show two distinct maxima, one between 101 and 103 km., the other between 105 and 108 km.

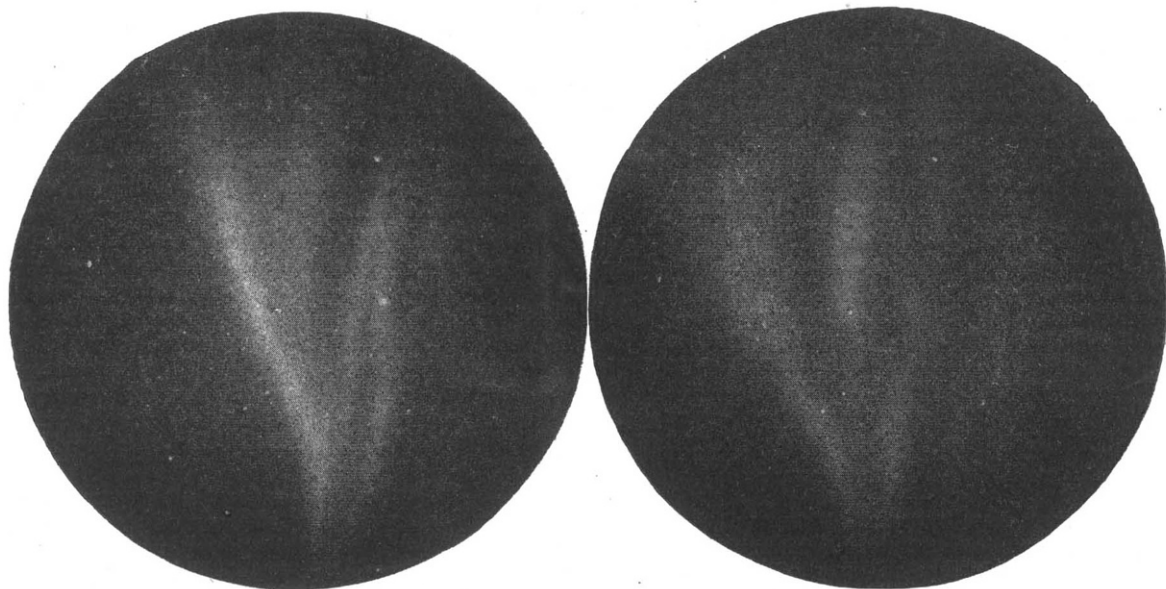


FIG. 2.—Aurora borealis, photographed simultaneously from Bossekop (right) and Store Korsnes (left) on March 30, 1913, 9h. 20m. G.M.T. Altitude of left border about 120 km. The stars of Lyra in the background.

The year 1913 was one of sunspot minimum, and Prof. Störmer seems disposed to associate sunspot minimum with low penetrating power in auroral rays, and so great height in the lower edge of aurora. This seems necessary to explain

the tannins, the last two applied either alone or with iron mordants. This short list represents a very restricted range of colours, dyeing in various shades of red, yellow, orange, blue, brown, and black. Green dyes were unknown to the dyers

of antiquity, who were forced to utilise mixtures of blue and yellow. The choice of medieval dyes was even narrower, for Tyrian purple became obsolete with the lapse of time, owing to the cost of production. But with the great geographical discoveries of the sixteenth century four new natural colouring matters were added to the list, namely, cochineal, logwood, quercitron, and fustic, and the use of indigo, which had fallen into abeyance, was revived.

The birth and development of modern chemistry added in the period 1790 to 1853 six more dyes and pigments: picric acid, chrome yellow, chrome green, Prussian blue, artificial ultramarine, and murexide. The period of intensive colour production began with Perkin's synthesis of mauve, since when many thousand dyes have been produced, of which about 3000 have at one time or another been utilised by dyers. The capture of this industry by German industrialists placed at the disposal of their military chiefs a new form of offensive, namely, war with poisons. The asphyxiating gases, chlorine and phosgene, and the lachrymatory liquid, benzyl bromide, were prepared in large quantities for the colour industry, and were ready to hand for a more nefarious use.

The tragic story of the red trousers adopted for the French Army constitutes one of the world-war's most cruel ironies. This colour was originally selected in order to encourage the cultivation of French madder, which colour principle was, however, entirely superseded by artificial alizarin in 1876. Nevertheless, the French War Office disbursed annually vast sums in the purchase of the latter dye from the Badische Anilin- & Soda-Fabrik, an astute German firm, which very obligingly established a special shade of alizarin red to suit the requirements of their French clients. With the outbreak of war the lives of thousands of France's incomparable soldiery were sacrificed to demonstrate that this excellent red, worn to support a dead industry, was an admirable target for the enemy.

This sombre episode is typical of the methods of peaceful penetration by means of which German industrialists endeavoured, only too successfully, for forty years before the war to acquire that chemical predominance which was to pave the way for military victory over their short-sighted rivals. The secret of this German success was to concentrate on essentials. Germany was alone at first in recognising what should be the correct relationship between theory and application, and between science and industry. Its Government assigned no limits to the endowment of universities and to the enrolment and encouragement of professors. The latter gained glory and profit from any of their discoveries receiving technical applications. German manufacturers prided themselves on possessing research laboratories rivalling, and often excelling, those of the universities. Sure of ultimate success, they no longer imposed on their research chemists the crippling task of obtaining immediately profitable results. Conscious that the field of inquiry is illimitable, they did not demand of their pioneers and prospectors payable dis-

coveries to order. As the result of this far-sighted policy, carried into practice by patient and systematically co-ordinated workers, German industrialists ultimately were enabled to make discoveries which rendered them masters not only of the colour industry, but also of all other industries depending on chemical synthesis, such as the manufacture of pharmaceutical and photographic products and the production of artificial perfumes. In this way the large German firms acquired a systematically recorded mass of detailed practical experience which is far more valuable to them than their financial resources. It is true that the principles underlying the production of dyes and other fine chemicals may be gleaned from a perusal of patent specifications and other scientific publications; yet these disclosures are more apparent than real, for it is certain that very few, if any, of these processes, if carried out as described, could meet the competition which existed before the war. Large staffs of experienced technical chemists are required to put these syntheses into effective operation.

In the meantime, non-German chemical manufacturers and chemical users had fallen to a position of subordination. The part played by the former was the collection of German intermediate products and the conversion of these substances into dyes, a comparatively simple and inexpert task compared with the highly skilled processes by which these intermediates were manufactured. The German manufacturers were very liberal towards their subordinates, and even encouraged the development of foreign factories of this type, realising that in these dependent enterprises they had very useful allies, which, by obscuring the ultimate origin of the dyes and other chemical products, neutralised national prejudice and flattered local patriotism by a spurious show of manufacturing activity.

One of these subservient French factories was at the outbreak of war devoted to the production of synthetic indigo from intermediates sent from Germany. This factory has since been requisitioned by the French Government, and with the aid of a committee formed to deal with chemical and pharmaceutical products is now organised to manufacture synthetic indigo for the new military uniforms.

It is satisfactory to note that a similar success has attended British efforts to cope with this important colour. The Rhenish firm of Meister, Lucius, & Brüning had installed at Ellesmere Port a factory in which only the last stage of their indigo synthesis was practised, in order that the firm might comply with the requirements of the English Patent Laws. Last year this factory was acquired by the Manchester firm of Messrs. Levinstein, Ltd., which at present is carrying out the indigo synthesis in all its stages on a larger scale than was the case when the works were still in German hands.

The steps taken in France to cope with the dye famine and other problems of chemical synthesis arising from the war are singularly comparable with those made in England. In both countries

the Government has intervened to form State-aided companies, and British Dyes, Ltd., has its French analogue in the "Société Nationale des Matières Colorantes et Produits Chimiques." Meanwhile, private enterprise has played a very important part. The last surviving independent French dye factory at Saint-Denis has greatly increased its capital and organised its resources in order to deal intensively with dye production as soon as the claims of the explosives departments have abated. In Lancashire, Messrs. Levinstein, who have achieved noteworthy success as dye-makers, now form the nucleus of a group of co-ordinated firms working amicably in the production of dyes and other synthetic products. These firms, which include the Ellesmere Port indigo factory and Messrs. Claus, of Clayton, near Manchester, have working arrangements with other industrial undertakings not only in Great Britain, but also so far afield as Italy and America. This combination of the Lancashire colour firms and their associates is at present a most hopeful sign of renaissance for the chemical industries of the Entente Powers.

G. T. MORGAN.

FRANCE AND NATIONAL SCIENTIFIC RESEARCH APPLIED TO INDUSTRY.

THE French Société d'Encouragement pour l'Industrie Nationale, always to the fore in matters of vital moment to industry, has recently been dealing with the question of scientific investigation as applied to manufacture. The "Economic Arts" Sub-Committee in particular is greatly interested in the co-ordination and co-operation of the various research and test laboratories in the country with the view of bringing science and industry into more direct contact after the war. In No. 1 (1917) of the society's Bulletin General Sebert has an article on the various establishments of the kind. Many of the Government departments in France have their own special laboratories, e.g. the various research laboratories of the French War Office and the Munitions Inventions Committee. A number of the scientific societies also have their own establishments, e.g. that founded by the Society of Electrical Engineers in 1886. Many tests are made there for different Government departments, and a number of important researches in electricity have been undertaken. Then there is the laboratory created by the French Photographic Society, which has done good work for the photographic profession and trade, and, more recently, for the cinematograph trade. By a decree passed in 1900 it was decided to widen the scope of the mechanical laboratory founded in 1854 by General Morin, the result being the foundation of the Laboratoire d'essais at the Conservatoire national des arts et métiers. To this institution many technical societies have made grants. It is divided into five sections, viz. physics, metals, materials of construction, mechanics, and chemistry. Here certain primary and secondary standards are kept. This laboratory has done good work in the carrying out of routine testing

of all kinds, but its operations are evidently circumscribed through lack of funds. The laboratory had to close at the beginning of the war, though it has since been reopened at the instance of the Munitions Inventions Committee for the carrying out of experiments relating to war problems.

Useful as such establishments are, however, there is a strongly felt desire to establish in France a National Laboratory on the scale of our own National Physical Laboratory, the Bureau of Standards (U.S.A.), and the Reichsanstalt at Charlottenburg.

M. Armand Gautier, of the Institute, recently expressed at the Academy of Sciences his personal ideas regarding the creation of a central laboratory of the kind, and an epitome of his contribution is printed in the Bulletin of the Société d'Encouragement already referred to. He suggests the formation of a council consisting of manufacturers of the first rank, scholars who are specialists in particular branches of science, and a small number of Ministers of State or members of the National Council. This council would draw up a list of the questions to be dealt with and appoint the most eminent men to carry out the investigations. The council would also approach the manufacturers, etc., who would be most likely to benefit from the researches, and the latter would do the rest by the provision of annual grants for the execution of the work. The State would have no responsibility, direction, or supervisory powers, but would provide the funds necessary for the establishment and equipment of the institution. Each manufacturer would undertake to assist according to the extent of his business, but the share of each would be fixed as low as possible. M. Gautier thinks that there would be no difficulty in inducing manufacturers to lend their support, as it is they who would most directly profit from the results of the researches.

E. S. HODGSON.

NOTES.

A CORRESPONDENT in Petrograd gives us a rather gloomy account of the difficulties of carrying on scientific work or publications under the present conditions in Russia. He says:—"It is, in fact, now almost impossible to print here scientific works having small circulations, as the prices demanded by the compositors, printers, papermakers, and other workers connected with the production of books are 200-300 per cent. higher than they were in February, immediately before the Revolution. The results are beginning to be felt already—factories are being closed and the number of unemployed getting larger every day. Scientific work and teaching are at present almost impossible, as many of the institutes and universities are 'requisitioned' by irresponsible revolutionary organisations and troops; thus the Polytechnic Institute has been occupied since March 5 by about 2500 soldiers, and as the sanitary arrangements were never intended for such a number of people, having no ideas of sanitation, living and sleeping in the lecture- and drawing-halls, the shameful state of the institute may be imagined. All efforts to eject these unwelcome guests and those of other organisations have proved abortive, as the 'Provisional Government'